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Peer to Peer Solar Energy Sharing using Blockchain in IOT

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A B S T R A C T

Emerging smart microgrid technologies have changed electric power infrastructure to work more efficiently. These technologies can help energy producer and the consumer to improve efficiency of energy usage. The energy sector is soon going to be privatized. However, existing systems are still not effectively implemented in domestic and commercial buildings to support the new privatized energy sector. A new set of systems will be required to run the privatized energy sector. The proposed system provides a new infrastructure for private energy producers to sell their energy to a consumer. The excess energy from the households with infrastructure to farm renewable energy is send back to the Main Grid. The excess renewable energy from households with renewable energy harvesting system can be sold with the other households in the same community which do not possess the same infrastructure. The proposed peer to peer energy trading system that operates through interaction between a smart energy microgrid network and a blockchain based system. The end users are the households in the community in which the proposed system is implemented.

Keywords: Fibre-reinforced polymer composites; PET bottle; Pulverization; Mechanical testing

1. Introduction

Asystem distributes power on an on-demand basis to maximize on-site solar usage. Each apartment will have a device that constantly monitors the energy usage (load) and feeds this information to the solar energy unit. Using this information, the solar energy will direct solar energy to the apartments in relation to how large their load is at any specific time. This optimized sharing means that the on-site solar usage is 30-35% higher than an individual system, limiting the amount of solar that is not used. The solar energy is the most efficient system to maximize the use of energy generated at any given time. It achieves this by supplying energy to where it is needed most, instead of sending it back to the grid. Any excess energy not used by an apartment (or common light and power) will be sent back to the grid and compensated for accordingly.

- A solar energy system can generate up to 40% savings on your electricity bills
- Any excess energy not used by an apartment is sent back to the grid and compensated for by your electricity retailer.
- This optimized sharing means that the on-site solar usage is 30-35% higher than an individual system.

The solar energy grid concept can be applied in any under-electrified area in the Global South with a minimum of 10 households or small and medium enterprises located close to each other, making the concept applicable and scalable for millions of households worldwide

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2. Literature Survey

This is data from a live solar energy install. The install consists of 8 units of varying energy demands. Every month the solar energy begins recording the amount of solar delivered to each unit. Units 1 and 8 are high energy users and 2-7 are average users. At the beginning of the month, the solar energy sends power at a ratio of the power that is being used, fully optimizing on-site solar usage. However, towards the end of the month, the solar energyidentifies that units 2-7 have received less than their fair share of solar. The solar energy, therefore, reduces the amount of solar that is sent to units 1 and 8 and distributes the excess to units 2-7. This active distribution optimizes the amount of onsite solar that is consumed, saving each user the most amount from their energy bills, while ensuring that everyone receives their fair share of solar energy. If the system is unable to equalize the amount of solar delivered to each unit by the end of the month due to unforeseen circumstances, like a few cloudy days, then the difference is rolled over to the following month. An example of this can be seen with unit 8. It received more energy than the other units in the first month so begins the next month at an increased starting point to the other units.

Module 1 (installation of solar panel)

The solar energy peer-to-peer electricity trading network enables the interconnection of households with and without solar home systems (SHS) into local electricity trading networks; increasing individual SHS utility by up to 30% and therefore providing more people with access to renewable electricity at a lower cost.

- Set Up Scaffolding. ...
- Install Solar Panel Mounts. ...
- Install the Solar Panels. ...
- Wire the Solar Panels. ...
- Install Solar Inverter. ...
- Bond Solar Inverter and Solar Battery. ...
- Connect the Inverter to the Consumer Unit. ...
- Start and Test Solar Panels.

Module 2 (installation of smart meter)

Each meter is installed in a household with or without an existing SHS. The device measures power inflows and outflows, contributes to overall grid control, allows for personal preferences of the users (i.e. buy or sell-only mode) and optimizes for battery state of charge. Interconnected solar energymeters form a solar energy electricity trading network, enabling peer-to-peer electricity trading in the village.

Module 3 (earning an income from their solar systems)

The ability of households to earn an income from their solar systems through the nanogrid opens up innovative business possibilities. For instance, households could reinvest their profits from solar energy trading to upgrade their solar technology to generate even more electricity and thus profit. Overnight, simple solar users are turned into smart entrepreneurs earning money real-time once their solar systems start producing a surplus of solar electricity. This surplus can easily be directly credited to their mobile money accounts. For its operation model, solar energy has long been hailed as the 'Uber' of the off-grid world. The heart of the solar energy electricity trading network is the back-end ICT-enabled data management and grid control system, which enables users to trade electricity, integrates mobile money infrastructure for remote payment, enables system monitoring and lockout and provides data analytics and grid optimization functionality. By reducing the initial investment needed to access clean energy technologies and encouraging each user to buy and sell electricity, the solar energy electricity trading network enables a bottom-up, micro-energy transition lead by the community itself.

3. Internet of Things

Internet of things (IoT) is playing a major and crucial role in the daily life of humans by enabling the connectivity of many and most of the physical devices through internet to exchange the data for monitoring and controlling the devices from a remote location, where the devices are becomes intelligent This technology can connect a wide range and varieties of things such as animals, humans, smart transport, smart grids, virtual power grids, smart cities, vehicles, heart monitoring systems, environmental sensing, shopping systems, automated homes, energy management, assistance for disabled and elderly individuals, cochlear implants, tracking of things, equipment manufacturing, agriculture, emergency monitoring systems, electronics tool collection systems, vehicle control etc. according to the survey there is a increase of 31% i,e 8.4 billion internet connected devices from 2016-2017. The connected device may increase to 30 billion by 2020 and which makes the business market around 7.1 trillion dollars by 2020

By using the IoT we can enable the machine to machine communication M2M or device to device communication without human intervention. In the modern life electricity became the important and essential part of the life. For any work now, a day we require electricity like lighting, heating, refrigeration, cooling, transportation systems what not all the home appliance works on electricity. In day to day life the consumption of electricity is increased but not decreased. To compete with the requirement of the public more and more electricity is to be generated and give to the end users. As the population increases the consumption also increases.

4. Implementation

System Implementation is the stage of the project when the theoretical design is tuned into working system. If the implementation system stage is not carefully controlled and planned, it can cause chaos. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the users a confidence that the system will work and be effective.

The implementation stage in a project involves,

- Careful Planning investigation of the current system, checking constraints and the implementation.
- Training the staffs in the newly developed system.

A software application in general is implemented after navigating the complete life cycle method of a project. Various life cycle processes such as requirement analysis, design phase, verification, testing and finally followed by the implementation phase results in a successful project management. The software application which is basically a Windows based application has been successfully implemented after passing various life cycle processes mentioned above.

As the software is to be implemented in a high standard industrial sector, various factors such as application environment, user management, security, reliability and finally performance are taken as key factors throughout the design phase. These factors are analyzed step by step and the positive as well as negative outcomes are noted down before the final implementation.

Security and authentication is maintained in both user level as well as the management level. The data is stored in MySQL, which is highly reliable and simpler to use, the user level security is managed with the help of password options and sessions, which finally ensures that all the transactions are made securely.

The application's validations are made, taken into account of the entry levels available in various modules. Possible restrictions like number formatting, date formatting and confirmations for both save and update options ensures the correct data to be fed into the database. Thus all the aspects are charted out and the complete project study is practically implemented successfully for the end users.

A .Arduino Uno

The Microcontroller used here is an Arduino UNO. The UNO is a Microcontroller board based on ATMEGA 328P.

The ATMEGA 328P has 32kB of flash memory for storing code. The board has 14 digital input and output pins, 6 analog inputs, 16 MHz quartz crystal, USB, an ICSP circuit and a reset button. The UNO can be programmed with the Arduino software.

B .Sensors

A sensor is a device, module, machine, or subsystem whose purpose is to detect events or changes depends upon tranducer in its environment and send the information to other electronics, frequently a microcontroller.A sensor is always used with other electronics**.**

C .ESP8266 wifi

The ESP8266 Arduino compatible module is a low-cost Wi-Fi chip with full TCP/IP capability, and the amazing thing is that this little board has a MCU (Micro Controller Unit) integrated which gives the possibility to control I/O digital pins via simple and almost pseudo-code like programming language. This device is produced by Shanghai-based Chinese manufacturer, Espressif Systems.

5. Result

Output design generally refers to the results and information that are generated by the system. For many end-users, output is the main reason for developing the system and the basis on which they evaluate the usefulness of the application.

The objective of a system finds its shape in terms of output. The analysis of the objective of a system leads to determination of outputs. Outputs of a system can take various forms. The most common are reports, screens displays printed form, graphical drawing etc. the outputs vary in terms of their contents, frequency, timing and format. The users of the output, its purpose and sequence of details to be printed are all considered. When designing output, the system analyst must accomplish things like, to determine what information to be present, to decide whether to display or print the information and select the output medium to distribute the output to intended recipients.

Internal outputs are those, whose destination is within the organization. It is to be carefully designed, as they are the user's main interface with the system. Interactive outputs are those, which the user uses in communication directly with the computer.

6. Conclusion and Future Work

As this system keeps continues track of solar power plant ,the daily weekly and monthly analysis becomes easy and efficient also with the help of this analysis it is possible to detect any fault occurred within power plant as the generated power may show some inconsistency in data of Solar power plant.

Since the system requires external power supply of 5 volts and 3.3 volts for its operation which can be taken rid of by utilising the power generated by solar panel only. Also with the help of motor and controlling it is possible to track the sun for better power generation. Apart from that by using various Machine Learning algorithms and model it is possible to make system smart enough to take decision about data and performance.
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